

What is claimed is:

1 1. A method for communicating data between a hub and an agent, the method
2 comprising:
3 determining a first estimated unused capacity left in a first microframe in which a first
4 hub-agent transaction is to be started;
5 determining an amount of a first data that can fit into the first estimated unused
6 capacity and that is to be sent to the hub during a first transaction and sent by the hub to the
7 agent during the hub-agent transaction; and
8 sending the first data to the hub during the first transaction.

1 2. The method of claim 1, further comprising determining at the hub whether the hub-
2 agent transaction is part of a transfer which spans two or more microframes.

1 3. The method of claim 1, further comprising determining at a host controller whether
2 the hub-agent transaction is part of a transfer which spans two or more microframes.

1 4. The method of claim 3, wherein the first transaction includes sending from the host
2 controller to the hub a multi-part indication indicating that the hub-agent transaction is part of
3 the transfer that spans two or more microframes.

1 5. The method of claim 2, further comprising, at the hub, determining a current unused
2 capacity left in the first microframe in which the hub-agent transaction is to be performed.

1 6. The method of claim 5, initiating at the hub the hub-agent transaction only when the
2 current unused capacity left in the first microframe is less than or equal to the amount of the
3 first data.

1 7. The method of claim 2, further comprising, at the hub, scheduling the hub-agent
2 transaction to start during the first microframe such that the first data takes at least until an
3 end of the first microframe to be sent to the agent.

1 8. The method of claim 7, further comprising:
2 sending the first data to the agent during the first microframe;
3 sending second data to the hub during the first microframe; and
4 sending the second data from the hub to the agent starting with the beginning of a
5 second microframe which immediately follows the first microframe.

1 9. The method of claim 2, further comprising:
2 starting the hub-agent transaction during the first microframe such that the first data is
3 not finished being sent to the agent until after a second microframe starts.
4 sending second data to the hub during the first microframe; and
5 sending the second data from the hub to the agent after the first data is finished being
6 sent during the second microframe.

1 10. The method of claim 8, further comprising:
2 sending to the hub third data during the second microframe;
3 sending the third data from the hub to the agent after the second data is finished being
4 sent to the agent.

1 11. The method of claim 8, wherein the second data is sent to the agent after the first data
2 is finished being sent to the agent without causing an underrun condition.

1 12. The method of claim 9, wherein the second data is sent to the agent after the first data
2 is finished being sent to the agent without causing an underrun condition.

1 13. A communication system for communicating data, comprising a host controller that is
2 to

3 (a) determine a first estimated unused capacity left in a first microframe in which a
4 hub-agent transaction is to be performed,

5 (b) determine an amount of a first data that can fit into the first estimated unused
6 capacity and that is to be sent from the host controller to the hub during a first transaction and
7 sent by the hub to the agent during the hub-agent transaction, and

8 (c) is to send the first data to the hub during the first transaction.

1 14. The system of claim 13, further comprising a hub that is to determine whether the
2 hub-agent transaction is a part of a transfer that spans two or more microframes.

1 15. The system of claim 13, wherein the host controller is to determine whether the hub-
2 agent transaction is part of a transfer that spans two or more microframes.

1 16. The system of claim 15, wherein, during the first transaction, the host controller is to
2 send to the hub a multi-part indication indicating that the hub-agent transaction is to be part
3 of the transfer that spans two or more microframes.

1 17. The system of claim 14, further comprising a hub that is to determine a current unused
2 capacity left in the first microframe in which the hub-agent transaction is to be performed.

1 18. The system of claim 17, wherein the hub is to initiate the hub-agent transaction only
2 when the current unused capacity left in the first microframe is less than or equal to the
3 amount of first data.

1 19. The system of claim 14, wherein the hub is to schedule the hub-agent transaction to
2 start during the first microframe such that the first data takes at least until the end of the first
3 microframe to be sent to the agent.

1 20. The system of claim 19, wherein the hub is to send the first data to the agent during
2 the first microframe, the host controller is to send second data to the hub during the first
3 microframe, and the hub is to send second data to the agent starting with the beginning of a
4 second microframe that is to immediately follow the first microframe.

1 21. The system of claim 19, wherein the hub is to start the hub-agent transaction during
2 the first microframe such that the first data is not finished being sent to the agent until after a
3 second microframe starts, the host controller is to send second data to the hub during the first
4 microframe, and the hub is to send the second data to the agent after the first data is finished
5 being sent during the second microframe.

1 22. The system of claim 20, wherein the second data is sent to the agent after the first data
2 is finished being sent to the agent without causing an underrun condition.

1 23. The system of claim 21, wherein the second data is to be sent by the hub to the agent
2 after first data is finished being sent and without causing an underrun condition.

1 24. A communications system for communicating data, comprising a hub that is to
2 (a) *receive first data during a first transaction with a host controller,*
3 (b) determine whether a hub-agent transaction in which the first data is to be sent to
4 an agent during a first microframe is part of a transfer which spans two or more microframes,
5 (c) send the first data when a current unused capacity left in the first microframe is
6 less than or equal to the amount of the first data.

1 25. The system of claim 24, further comprising a host controller that is to
2 (a) determine a first estimated unused capacity left in the first microframe in which
3 the hub-agent transaction is to be performed between the hub and the agent,
4 (b) determine an amount of a first data that can fit into the first estimated unused
5 capacity and that is to be sent from the host controller to the hub during a first transaction and
6 sent by the hub to the agent during the hub-agent transaction, and
7 (c) ~~is to send~~ the first data to the hub during the first transaction.

1 26. The system of claim 25, wherein the host controller is to determine whether the hub-
2 agent transaction is part of a transfer which spans two or more microframes.

1 27. The system of claim 26, wherein the host controller is to send to the hub during the
2 first transaction a multi-part indication indicating that the hub-agent transaction is part of a
3 transfer which spans two or more microframes.

1 28. The system of claim 27, wherein the first data is to take at least until an end of the
2 first microframe to be sent to the agent, and the host controller is to send to the hub second
3 data during the first microframe.

1 29. The system of claim 28, wherein the hub is to send the second data to the agent
2 substantially immediately after the first data is finished being sent.

1 30. A communication system comprising a host controller that
2 (a) determines a first estimated unused capacity left in a first microframe in which a
3 hub-agent transaction is to be performed between a hub and an agent,
4 (b) determines an amount of a first data that can fit into the first estimated unused
5 capacity and that is to be sent from the host controller to the hub during a first transaction and
6 sent by the hub to the agent during the hub-agent transaction, and
7 (c) sends the first data to the hub during the first transaction.

1 31. A computer readable storage medium having stored thereon instructions which when
2 executed by a processor in a host result in:

3 determining a first estimated unused capacity left in a first microframe in which a
4 hub-agent transaction is to be performed between a hub and an agent; and

5 determining an amount of a first data that can fit into the first estimated unused
6 capacity and that is to be sent from the host controller to the hub during a first transaction and
7 sent by the hub to the agent during the hub-agent transaction:

1 32. The storage medium of claim 31 having stored thereon instructions which further
2 result in:

3 determining whether the hub-agent transaction is part of a transfer which spans two or
4 more microframes.

1 33. The storage medium of claim 31 having stored thereon instructions which further
2 result in:

3 sending from the host controller to the hub a multi-part indication indicating that the
4 hub-agent transaction is part of the transfer that span two or more microframes.

1 34. A computer readable storage medium having stored thereon instructions which when
2 executed by a processor in a hub result in:

3 receiving first data during a first transaction with a host controller;

4 determining whether a hub-agent transaction in which the first data is to be sent to an
5 agent during a first microframe is part of a transfer which spans two or more microframes;
6 and
7 sending the first data when a current unused capacity left in the first microframe is
8 less than or equal to the amount of the first data.

1 35. The computer readable storage medium of claim 34 having stored thereon instructions
2 which further result in:
3 receiving second data during a second transaction with the host controller;
4 sending the second data to the agent after the first data is finished being sent to the
5 agent.